

TECHNICAL REPORT

PS SERIES BEST PRACTICES DEPLOYING WINDOWS SERVER 2008 WITH PS SERIES SANS

ABSTRACT

This Technical Report describes some best practices when using Dell EqualLogic™ PS Series arrays in Microsoft Windows Server 2008 environments.

Microsoft
GOLD CERTIFIED
Partner



TR1042

V1.0

Copyright © 2008 Dell Inc. All Rights Reserved.

Dell EqualLogic™ is a trademark of Dell Inc.

All trademarks and registered trademarks mentioned herein are the property of their respective owners.

Possession, use, or copying of the documentation or the software described in this publication is authorized only under the license agreement specified herein.

Dell, Inc. will not be held liable for technical or editorial errors or omissions contained herein. The information in this document is subject to change.

January 2009

Dell, Inc.
Nashua Design Center
300 Innovative Way
Suite 301
Nashua, NH 03062 USA
Tel: 603.579.9762
Fax: 603.579.6910

TABLE OF CONTENTS

Revision Information	iv
Introduction.....	1
Benefits of Deploying Windows with PS Series Storage	1
Planning and Design Considerations	3
High-Level Considerations	3
Disk Storage Considerations.....	4
Network Considerations.....	7
Server Considerations	8
Management and Disaster Recovery Considerations	12
Preparing for Deployment.....	15
Set up the PS Series Group and Create Volumes	16
Set up the Windows Server.....	19
Connect to PS Series Volumes	22
Configure Basic Disks	26
Additional Operations	29
Expanding SAN Storage Online	29
Shrinking Windows Server 2008 Volumes.....	31
Backing Up Data with VSS	31
Summary	32
For More Information	33
Technical Support and Customer Service	33

REVISION INFORMATION

The following table describes the release history of this Technical Report.

Report	Date	Document Revision
1.0	January, 2009	Initial Release

The following table shows the software and firmware used for the preparation of this Technical Report.

Vendor	Model	Software Revision
Microsoft®	Windows® Server™ 2008 All Editions	
Microsoft®	iSCSI Software Initiator	Version 2.07
Dell	Host Integration Tools for Microsoft Windows	Version 3.1.2 and later.
Dell	PS Series Array Firmware	Version 4.0.5 and later.

The following table lists the documents referred to in this Technical Report. All PS Series Technical Reports are available on the EqualLogic website at: <http://www.equallogic.com/resourcecenter/documentcenter.aspx>

Vendor	Document Title
Microsoft®	Windows Server 2008 Deployment http://technet.microsoft.com/en-us/cc339386.aspx
Microsoft®	Shrinking a Basic Volume http://technet.microsoft.com/en-us/library/cc731894.aspx
Microsoft®	Microsoft System Center Data Protection Manager http://www.microsoft.com/windowsserversystem/dpm/default.mspx
Dell EqualLogic™	Deploying Microsoft System Center DPM 2006 in an iSCSI SAN
Dell EqualLogic™	Choosing a Member RAID Policy
Dell EqualLogic™	Deploying Tiered Storage in a PS Series SAN
Dell EqualLogic™	PS Series Array Network Performance Guidelines
Dell EqualLogic™	Sizing Replication Space
Dell EqualLogic™	Configuring and Deploying the Dell EqualLogic Multipath IO Device Specific Module (DSM) in a PS Series SAN
Dell EqualLogic™	Using Active Directory for Account Authentication to a PS Series Group
Dell EqualLogic™	Expanding Basic Disk Volumes

INTRODUCTION

Together, Microsoft and Dell make it possible for businesses of all sizes to leverage their existing network infrastructure by supporting block-based storage over IP-based networks. To obtain the benefits of consolidated storage, customers no longer have to invest in complicated Fibre Channel network hardware and software—not to mention personnel training costs—keeping expenses down and reducing the total cost of ownership.

Grouping together one or more Dell EqualLogic™ PS Series storage arrays permits users to design an intelligent iSCSI storage area network (SAN) that provides a highly-available and scalable storage environment. PS Series arrays include complete redundant hardware and enterprise software that enables administrators to automate data protection plans using state-of-the-art snapshot and replication technologies that are included at no additional cost. In addition, multiple arrays can be grouped together in a SAN to allow for storage tiering and RAID-level optimization of storage that delivers the best performance and scalability from the storage subsystem.

The PS Series software also includes tools that integrate with Windows® Server technologies such as Volume Shadow Copy Services (VSS), Virtual Disk Services (VDS), and Multipath IO (MPIO) to enable higher performance and protection of Windows servers. The Host Integration Tools kit for Windows® includes a suite of tools including a VSS provider service, a MPIO Device Specific Module (DSM), and Auto-Snapshot Manager-Microsoft Edition, which acts as a VSS requesting application to dramatically improve backup operations by creating flexible, space-efficient point-in-time copies of data, called Smart Copies. This technical report will discuss these technologies and the best practices to deploy PS Series arrays with Window Servers.

BENEFITS OF DEPLOYING WINDOWS WITH PS SERIES STORAGE

Traditionally, many servers have used direct attached storage (DAS) that is difficult to provision and scale. In addition, for shared data, cluster nodes use external parallel SCSI buses that require servers to be physically close together. Having several types of storage means that administrators must use different data protection and management procedures. In addition, DAS has been unable to overcome cable length and storage sharing limitations, leading to fragile storage configurations that are difficult to set up and alter.

SAN configurations can improve storage flexibility by providing the ability to connect multiple server nodes to a common pool of storage. However, typical Fibre Channel based SAN configurations are complex, expensive to deploy and manage, and require special switches in addition to special host bus adapters (HBAs) in the servers. PS Series storage solutions have the ability to rise above the limitations of DAS and traditional Fibre Channel SANs. Based on the iSCSI protocol, PS Series storage utilizes familiar SCSI and IP technologies to deliver an affordable and easy-to-manage consolidated storage solution.

The basis of a Dell EqualLogic™ iSCSI SAN is the PS Series storage array, a no-single-point-of-failure device. Each array contains redundant network interfaces and controllers that scale together with other PS Series arrays when combined in the same PS Series group. Unlike traditional frame-based storage systems, when administrators need to scale a PS Series SAN they simply add a new PS Series array to the group and all aspects of the SAN scale linearly through additional physical disks, controllers, and networks ports on each array. Combining reliability and scalability with an easy-to-use management interface, PS Series storage provides virtualization and high-end features in a single offering — the all-inclusive software package provides full access to array and host-based EqualLogic features with no additional licensing costs.

Dell EqualLogic™ PS Series storage arrays are Microsoft Simple SAN for Windows Server certified, ensuring full compatibility with Windows Server platforms and technologies. Volume Shadow Copy Service (VSS), Virtual Disk Service (VDS), and Multi-Path Input/Output (MPIO) are fully supported in all PS Series arrays.

The benefits of deploying Windows Server in a PS Series SAN are as follows:

- **Rapid deployment and configuration of Windows Server volumes** – A simple setup utility enables users to quickly configure an array on the network and create a PS Series group.
- **Excellent Performance and Scalability** – Intelligent PS Series storage arrays are self-scaling, with I/O performance that increases as the number of arrays in the SAN increases. When a new array is added, its resources are integrated into the SAN and immediately available to the virtualized storage pool. In addition to its storage capacity, the new array's disk spindles, controller cache, and GB Ethernet ports provide for enhanced performance and throughput.
- **Redundant hardware and hot serviceable configuration** – PS Series storage arrays are fully redundant with dual controllers, power supplies, and fans — all of which can be serviced online, without disrupting applications. In addition, support for multipath I/O provides end-to-end redundancy for Windows Server storage.
- **Data protection** – RAID and spare disks ensure data is protected on the disks. Complete hardware redundancy and hot-service capabilities assure uninterrupted operation. Enhanced data protection with snapshots, volume clones, and replication between groups is included.
- **Simple and immediate Windows Server 2008 volume expansion** – With modular PS Series storage arrays Windows's volume sizes can be quickly increased and partitions extended using Windows Server Disk Manager Service.
- **SAN boot capability** – Using iSCSI host bus adapters (HBAs) or onboard server network interfaces that support SAN boot capabilities, users have the ability to install and boot the Windows operating system from a PS Series volume, increasing disaster tolerance. When server hardware fails, the server can be quickly removed and replaced with a similarly-configured spare hardware platform. This new platform can be directed to the SAN boot volume and, in minutes, resume providing application services.
- **Network path protection and load balancing** – Using multiple NICs or iSCSI HBAs with the Microsoft iSCSI Software Initiator, you can configure multipath I/O and increase the reliability and performance of Windows Servers. Also known as MPIO, multipath I/O enables the dynamic load balancing of iSCSI SAN traffic across redundant paths between the Windows Server and the PS Series SAN. Using the EqualLogic MPIO DSM enhances MPIO by including a connection awareness module that translates and optimizes Windows Server connections to PS Series volumes.
- **Advanced management features** – PS Series storage comes standard with a comprehensive set of features including:
 - Automatic load balancing
 - Virtual storage management
 - Space-efficient snapshots for instant backup and recovery

- Volume cloning for rapid server provisioning
- Auto-replication for a comprehensive disaster recovery solution
- Storage pools or tiering enabling a “SAN within a SAN”
- Member-by-member RAID level control
- **VSS-based backups** – The EqualLogic Host Integration Tools kit includes a VSS Provider service and a VSS Requestor application called Auto-Snapshot Manager-Microsoft Edition that interacts with VSS Writers that are included with enabled applications. VSS operations are coordinated between Requestors, Writers, and Providers to dramatically improve backup operations by creating flexible, space-efficient, application consistent point-in-time-copies of data called snapshots. These snapshots may be used by VSS aware backup software to provide serverless backup via the SAN, or kept for rapid data recovery using the Auto Snapshot Manager tools.
- **Remote site volume replication** – With the PS Series auto-replication capability, Windows Server data can be automatically transferred to onsite and/or offsite remote data centers, protecting the data from serious failures ranging from the destruction of the volume to a complete site disaster.

PLANNING AND DESIGN CONSIDERATIONS

This section covers issues that you need to consider when planning and designing Windows Server 2008 in an EqualLogic iSCSI SAN.

High-Level Considerations

When designing a Windows Server 2008 environment, you should understand these general challenges:

- Reliability, Availability, and Serviceability
- Performance
- Scalability
- Recoverability
- Ease of management
- Service level commitments

It is critical to focus on these challenges *before* you begin the initial Windows Server 2008 installation. The following sections describe how to design a dependable Windows Server 2008 environment that uses PS Series storage to overcome many of the challenges facing IT managers.

Reliability, Availability, and Serviceability

The environment must be robust, resilient, and easily repaired by hot swapping components while the system remains available. In a SAN configuration, the server, network, and storage arrays should all have a robust level of fault tolerance to avoid costly downtime and allow scheduled maintenance to take place without service disruption.

You can easily build fault tolerance into your Windows Server 2008 storage environment by using PS Series storage arrays, which provide high availability and scalability, in addition to hot-swappable hardware and MPIO support. Not only does PS Series storage have a low initial cost, the benefits increase as your environment grows.

Performance

The environment must optimize application performance and response time. Data access is a large and important part of day-to-day operations for most companies, and under-performing servers can have a devastating effect on overall productivity. In addition, network issues and switch configuration can affect performance.

You can easily distribute data in a way that takes optimum advantage of PS Series storage capabilities to maximize application performance.

Scalability

As your workload grows and storage capacity needs increase, the environment must accommodate changes without affecting users. Storage used in a Windows Server 2008 environment must be highly scalable to accommodate changes in the workload, including additional users, increased capacity needs, and an overall increase in SAN activity.

Modular PS Series storage arrays provide easy, online scalability.

Recoverability

It must be possible to recover from situations that can cause data loss, ranging in scale from a corrupted or infected file to the loss of an entire data center due to hostile action or act of nature.

PS Series storage arrays deliver snapshots and auto-replication technology as standard features, enabling protection and disaster recovery capabilities for your critical data.

Ease of Management

Setup and configuration, backup and recovery, and day-to-day administration should be handled easily and have minimal impact on operations and users.

PS Series storage automates complex tasks like RAID configuration and provides both graphical and command line user interfaces for easy and intuitive storage management.

Service Level Commitments

Organizations often have varying service level requirements across applications. One application might be critical to business results, while another might require segregation of storage resources to meet application best practices or organizational needs.

PS Series storage allows for differing performance and availability levels through the choice of arrays and RAID levels, while the ability to store data on physically discrete pools allows a PS Series storage to meet data segregation commitments.

Disk Storage Considerations

There are a variety of storage considerations when deploying Windows Server. Key disk storage considerations include:

- Using highly-available disk storage
- Ensuring data reliability and performance with RAID technology
- Choosing the optimal RAID level for each member
- Optimally distributing I/O across disk devices
- Providing scalability
- Considering application tiering

Using Highly Available Disk Storage

For fault tolerance and redundancy, the primary focal point is the disk subsystem where the Windows Server data is located. Storing data in a PS Series group—one or more PS Series storage arrays connected to a standard IP network—ensures both reliability and availability.

Each PS Series storage array is hot serviceable and fully redundant, with dual power supplies, fans, and control modules, in addition to multiple Gigabit (Gb) Ethernet interfaces. Automatic RAID protection and disk sparing protects data from disk failures.

With no-single-point-of-failure PS Series storage arrays, you can set up a SAN that can survive hardware failures and be serviced online, thus avoiding unplanned downtime and service “brown-outs.”

Ensure Data Reliability and Performance with RAID Technology

RAID (redundant array of independent disks) is a technology that protects data from disk failures. The PS Series storage arrays in a group can be configured with RAID 5, RAID 10, or RAID 50. Based on the RAID policy you select, each array automatically configures its own RAID subsystem, eliminating the need for complex and error-prone manual procedures. In addition, each array automatically configures spare disks and uses them in the event of a disk failure.

Choose the Optimal RAID Level

Before creating a PS Series group, you should determine which RAID level to configure on each of the group members (storage arrays). The ability to set the RAID level for each member of each pool gives you great flexibility in designing this aspect of your Windows Server installation.

For more information on RAID levels in a PS Series group, see the *Choosing a Member RAID Policy* Technical Report on the EqualLogic website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Optimally Distribute I/O across Disk Devices

Where data is written and the storage subsystem configuration can have a huge impact on performance. Manual provisioning and tuning of storage can be a time-consuming, complex, and error-prone task. In contrast, PS Series storage automates storage provisioning and RAID configuration, providing optimal performance without user interaction.

Note: When the SAN contains multiple storage pools, each pool acts independently within the SAN, with performance optimization occurring within each pool.

For the best performance, I/O should be distributed across multiple disk drives (spindles) and multiple drive controllers to balance read and write requests. In most DAS and SAN configurations (other than Dell EqualLogic), the IT administrator is responsible for the specific data layout on storage-related hardware, including disks, controllers, and network links. The administrator must understand effective capacity utilization, as well as performance balancing across controllers, spindles, and controller ports.

When using PS Series storage, there is no need to manually provision data, because each pool in the group automatically distributes I/O across all its constituent storage arrays — with no interruption in data availability. This process includes data distribution not only across spindles, but also across controllers and network ports. In addition, volumes can be expanded on demand. There is no manual tuning or management and no downtime for storage reconfiguration.

Provide Scalability

You may need to expand the storage supporting your Windows Server environment if:

- New servers require new volumes.
- Existing server volumes grow beyond the space available within their pools.
- Performance and response time needs improvement.

When using DAS, adding usable storage to an existing configuration usually requires a full backup, the installation of a new and bigger storage subsystem, and then a full restore—resulting in long downtime and many hours of work.

In contrast, by simply adding arrays to the affected pools (and creating additional volumes when needed), you can seamlessly increase the capacity of a PS Series SAN—on demand and without affecting availability. Expanding the SAN also can improve fault tolerance and increase performance. As network interfaces, controllers, and arrays are added, performance scales linearly, and the load balancing of data and network I/O occurs automatically.

Consider Application Tiering

Unless all the applications stored on the SAN have the same performance and availability requirements, along with the same service level agreements, consider implementing tiered storage architectures. Dividing applications into tiers and adjusting the characteristics of the storage assigned to each tier optimizes the performance of the applications.

When using a SAN built from PS Series storage arrays, storage pools provide a method for implementing tiers. Within each pool, individual PS Series arrays can be configured to best support the needs of each tier, thereby optimizing storage performance for the tier, see Figure 1.

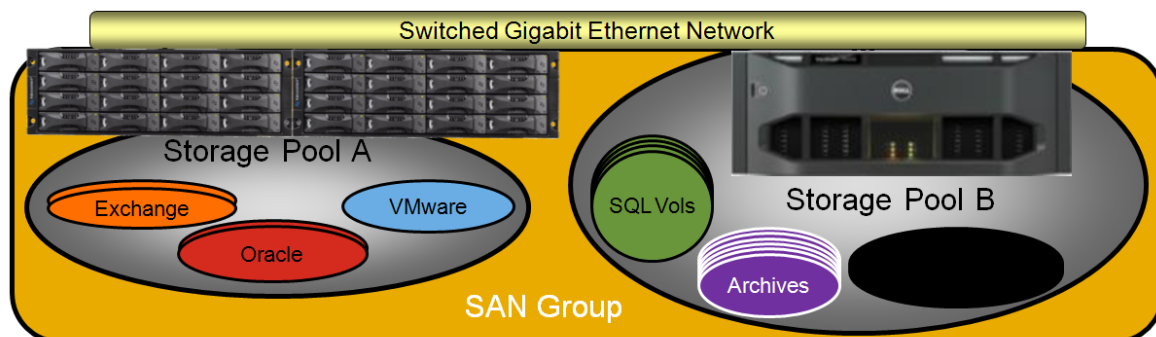


Figure 1: Tiered PS Series Arrays

For more information on tiering and pools within a PS Series group see the *Deploying Tiered Storage in a PS Series SAN* Technical Report on the EqualLogic website: (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Network Considerations

The key network issues to consider when deploying Windows Server are described below. These are:

- Setting up redundant network paths
- Optimally configuring the network and switches
- Optimizing server iSCSI connectivity

Set Up Redundant Network Paths

As a best practice for availability and performance, you should provide at least two paths for each type of network traffic. For example, you should configure separate server interfaces to provide multiple paths for the following:

- LAN traffic between the users and the Windows server.
- SAN traffic between the Windows server and the PS Series storage arrays.

The server network interfaces that are connected to the user network (LAN) should consist of two or more network interface cards (NICs). Optimally, you should use dedicated switch hardware to isolate the SAN traffic from the LAN traffic. Otherwise, configure VLANs on the switches and place the LAN and SAN on separate subnets.

For the LAN traffic, NIC teaming (bonding) can be used on the servers, depending on the network topology employed. NIC teaming is not supported for SAN traffic; use MPIO (discussed below) instead.

To handle SAN traffic, each PS Series storage array has three active 1Gb Ethernet interfaces. We recommend that you configure at least two network interfaces on each array and connect the interfaces to separate gigabit Ethernet switches to improve traffic distribution and increase redundancy.

In addition, to ensure that there is an available path between each Windows server and the PS Series group, we recommend that you configure multiple interfaces on the server for SAN traffic (either Gb Ethernet NIC interfaces or iSCSI HBAs) and then configure multipath I/O (MPIO) on the interfaces.

Configure the Network and Switches

Implementing the correct networking infrastructure is crucial to trouble-free server operation. We recommend that the SAN is configured in a redundant fashion. The benefit of this configuration is that no single point of failure exists. This configuration would include multiple network switches configured such that each network can operate (and fail) independently.

For more information on configuring the network and switches, consult the *PS Series Array Network Performance Guidelines* Technical Report on the EqualLogic website: (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Optimize Server iSCSI Connectivity

PS Series group volumes appear on the network as iSCSI targets. To connect a Windows Server to a PS Series volume, you need an iSCSI initiator. You can use an iSCSI software initiator and NIC combination, or you can use an iSCSI HBA.

Using a NIC with an iSCSI software initiator will provide good performance in most installations. However, an iSCSI HBA may improve performance by offloading CPU processing.

Another factor to consider is the placement of these devices on the server I/O buses. For example, in older servers it can be helpful to install your interface in a PCI-X slot to benefit from the higher clock speed (133 MHz). Some servers have multiple PCI-X buses, and in cases where there are two or more HBAs or NICs configured for MPIO, it can be beneficial to install these PCI-X devices on separate PCI-X buses. Consult your server hardware documentation for the best placement of add-in cards.

Server Considerations

Important server-side deployment considerations include:

- Booting servers from the SAN
- Using multipath I/O (MPIO)
- Using clustering services
- Configuring sufficient memory
- Optimizing server memory resources
- Aligning disk sectors
- Formatting volumes as basic disks
- Defragmenting NTFS drives
- Distributing applications across resources

Boot Servers from the SAN

When using Windows Server with a PS Series SAN, you can configure the servers to boot from an image of the operating system on a PS Series volume. Using SAN boot, all server storage, including the system disk, can be hosted on the SAN. This is an efficient way of managing servers, regardless of whether you have a few servers or hundreds of servers, and enables you to consolidate and more effectively handle storage resources.

SAN boot provides the following benefits:

- Simplified recovery from server failures – If a server experiences a hardware failure, you can avoid a lengthy restore process (that is, reinstalling the operating system and applications and restoring a backup copy of the data from tape to a replacement server). Instead, simply boot the replacement server from the SAN using the failed server's original boot image.

- Server consolidation – Booting from SAN means Windows servers do not need local or direct-attached storage. By configuring each server to boot from a PS Series volume, you can deploy diskless servers that consume less facility space, require less power, and are easier and less expensive to manage.
- Centralized storage management and data protection for the system disk – By storing server boot images, in addition to Windows Server data, in a PS Series SAN, all server data is protected by the hardware redundancy, RAID, and volume snapshots in the PS Series storage arrays.
- Rapid disaster recovery – By storing server boot images and production data in a PS Series SAN, you can replicate data to a secure offsite facility for an efficient and reliable disaster recovery solution. EqualLogic replication allows you to copy data from one group to another, typically at a remote location. If a disaster destroys data at the primary site, you can recover data at the recovery site. Servers can then be pointed to the new location of the data and can resume operation, thus minimizing downtime.

To boot a Windows server from a PS Series volume, an HBA, NIC, or dedicated PXE (Preboot eXecution Environment) boot technology must be installed in the server. For more information on SAN Boot using PS Series storage, see the *Booting Windows 2003 from a PS Series SAN* Technical Report on the EqualLogic website

(<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Use Multipath I/O

Multipath I/O (or MPIO) is the ability to use more than one physical path to a storage device, improving server reliability, performance, and availability through path redundancy and I/O traffic load balancing. MPIO can be implemented using standard network interfaces with the Microsoft iSCSI Software Initiator or third-party HBAs combined with the Microsoft iSCSI Software Initiator.

Figure 2 shows a typical recommended network path topology for a Windows Server installation.

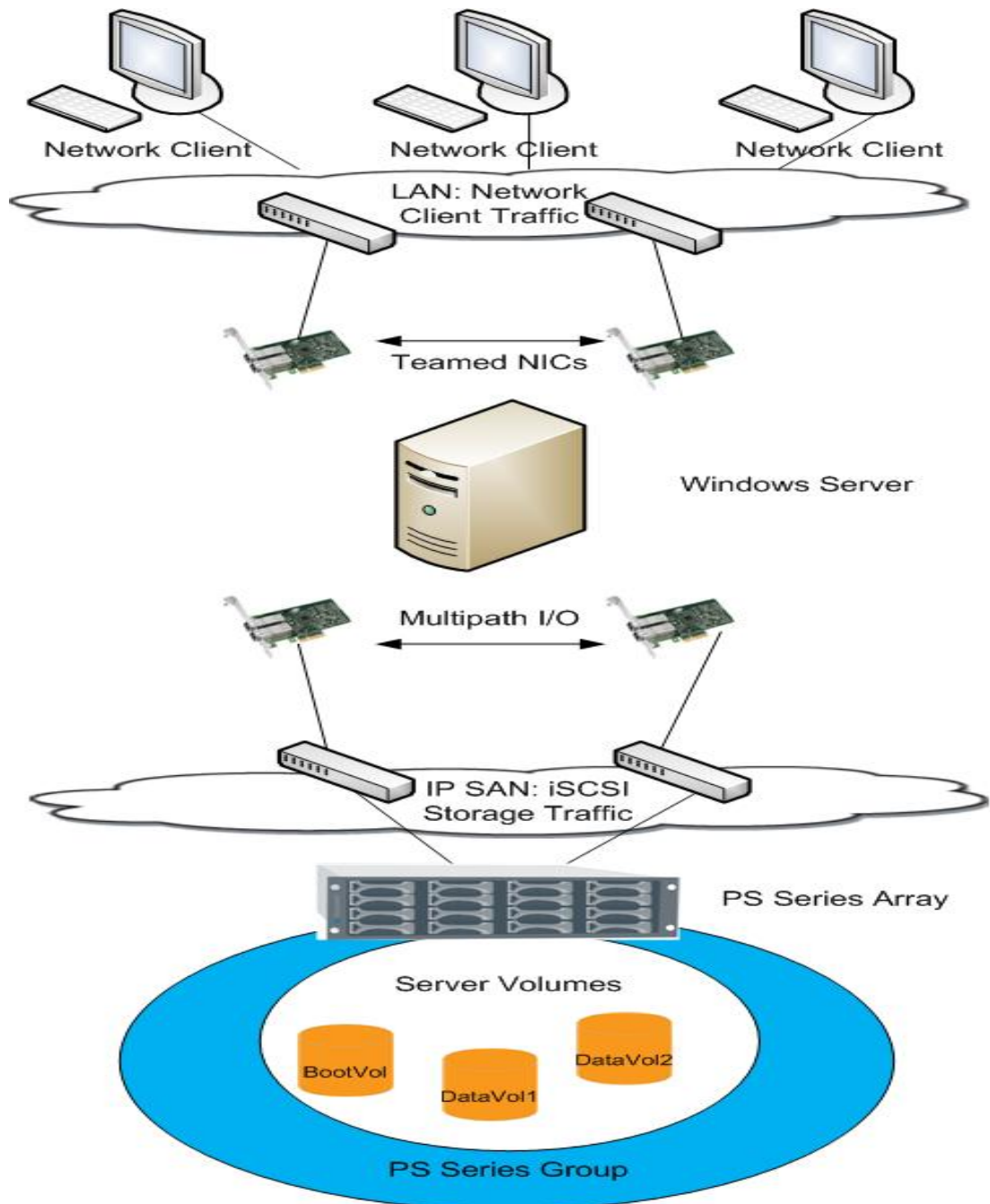


Figure 2: Windows Server Network Redundancy

Use Clustering Services

You can implement N+1 cluster operations by using Windows Cluster services, which uses a shared-nothing model. Each cluster node owns and manages its local devices. External cluster devices, such as shared disk arrays and the connection media for accessing those disks, are owned and managed by one node at a time. In the event of a node failure, a functioning node can take over processing activity from the failed node.

Windows Cluster servers can easily be configured to use a PS Series SAN for shared disk storage for quorum and disk resources, improving overall cluster availability and providing easy storage scalability.

For more information on clustering, consult the *Deploying Microsoft Windows Clustering in an iSCSI SAN* Technical Report on the EqualLogic website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Configure Sufficient Memory

Server memory configuration can affect the storage I/O load and performance. Configuring sufficient memory will make a Windows server and applications more efficient in their use of storage resources. In contrast, configuring Windows without sufficient memory will generate heavier I/O loads to storage.

Consult your application deployment guides for more information.

Optimize Server Resources

By providing enough memory and tuning your server to match the functions it will perform, you can get the maximum benefit from using PS Series storage. Windows Server provides options for optimizing processor performance options as well as file and printer sharing settings.

For more information, see the *Processor Scheduling* and *File and Printer Sharing* topics in the Windows help system.

Align Disk Sectors

For optimal performance, best practice calls for aligning the disk sectors so that they match the PS Series storage array RAID stripe segment size, thereby improving I/O performance. Windows 2008 includes out-of-box sector alignment for storage disks when they are created for the first time on Windows 2008. The user may choose to override the default alignment.

For more information, see the *Aligning Disk Sectors for Optimal Performance* Technical Report on the EqualLogic website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Format Volumes as Basic Disks

After a Windows server connects to a PS Series volume, it appears as a local disk. By default, the disk will be formatted as a basic disk. Do *not* convert the disk to a dynamic disk unless the application requires it.

There are several reasons why you must use basic disks:

- The utilities used to align disk sectors, can only be used with basic disks.
- Microsoft Windows Cluster Services currently does not support dynamic disks.

Defragment NTFS Disks

The amount of performance degradation due to NTFS fragmentation varies by server and application. For high performance, you must minimize fragmentation. Therefore, it is recommended that you defragment NTFS on new servers before putting them into production.

Also, you should defragment NTFS on a regular basis. The frequency of defragmentation depends on the environment and the frequency of changes to the file system. However, many third-party disk defragmenter tools can be scheduled to run in the background and only if necessary, without disrupting normal operations.

Distribute Applications across Resources

In some businesses, a single server handles multiple functions in an attempt to decrease hardware and licensing costs. Having fewer servers to manage can also decrease management overhead. There also may be compelling reasons to share network resources such as network links.

However, as an organization grows, shared server and network resources can result in performance bottlenecks. Depending on usage profiles and the interaction between different applications, competition for shared resources and resource exhaustion may produce unpredictable behavior that is difficult to diagnose.

Although a single Windows server can service multiple applications (including file serving, e-mail, database, and other services), as the workload increases, it is recommended that you use more than one server to handle the services. However, all the storage used by the servers can be located in the same PS Series group. Automatic load balancing across the storage arrays in the group ensures optimal performance and data availability.

Management and Disaster Recovery Considerations

Storage used in a Windows Server environment must be easy to manage, and the data must be protected from disasters and quickly recoverable when needed. The following sections describe various ways to improve administration for backup and restore operations, including:

- Separating data into multiple volumes
- Using snapshots and VSS shadow copies
- Backing up data to disk media
- Using near-continuous backup and archiving
- Using PS Series auto-replication technology

Separating Data into Multiple Volumes

To provide the greatest amount of management flexibility and improve backup and recovery operations, create separate volumes for each type of data. In other words, if a server will be both a file server and a database server, create one volume for shared files, another volume for the database files, and another volume for the database logs.

If the storage pool that will hold the data contains multiple arrays, there is another benefit to segregating different types of data onto different volumes. Different RAID levels can be assigned to the arrays in the pool. The PS Series firmware will monitor each volume's I/O profile over time

and assign the volumes to arrays that most closely match the performance characteristics of the volumes.

PS Series SANs allow you to create collections of volumes that are protected as a group, so storing related data on multiple volumes presents no obstacles to easy backup and recovery.

Using Snapshots and VSS Shadow Copies

A PS Series group provides the ability to create snapshots which are point-in-time copies of volume data. Snapshots enable you to quickly copy data at the disk (PS Series volume) level without disrupting access to the volume. This stable copy of the data can then be used as the source for backup and disaster recovery operations.

For example, creating a snapshot prior to installing a patch or performing an upgrade makes it possible to quickly recover if that change fails for some reason.

A snapshot is created nearly instantaneously and stored in the same group and pool as the original volume, providing both high performance and low disk space utilization. By recording only the changes that have occurred since its creation, the snapshot occupies only a fraction of the space that a full copy requires.

Microsoft enabled a framework within Windows Server called Volume Shadow Copy Service (VSS). The VSS framework integrates VSS-aware storage hardware and applications with operating system drivers to create coordinated point-in-time copies of data (called *shadow copies*), — delivering a turn-key backup solution to IT departments without the need for scripting.

The VSS architecture consists of three parts including a VSS requestor, writer, and provider service. The VSS requestor acts as a requesting application that initiates the shadow copy process. The VSS writers are built into the VSS aware applications and pause or quiesce the application to prepare for a consistent copy. The VSS provider is supplied by storage vendors and enables the creation of the copy on the storage subsystem. VSS coordinates these elements to enable application consistent copies of data that can be used for additional long term backup operations or quick recovery operations of server and application data.

When used with the Dell EqualLogic Host Integration Tools Kit, PS Series arrays can serve as the storage hardware in VSS-aware backup solutions. Auto-Snapshot Manager Microsoft Edition supports protection of Microsoft applications through PS Series snapshots, volume clones, and auto-replication for disaster recovery. Additionally third party backup applications can utilize the PS Series VSS provider service to create host snapshots on a PS Series SAN that can then be used for Server-less backups.

For more information, see the *Host Integration Tools for Microsoft Windows* documentation and any third party backup vendor documentation. The Host Integration Tools Kit for Windows and Auto-Snapshot Manager Microsoft Edition are available at no additional cost or licensing fees on a CD provided with a PS Series array or via a download at <http://www.equallogic.com/resourcecenter/documentcenter.aspx>.

Backing Up Data to Disk Media

SAN storage can be used as backup media (for example, in a disk-to-disk or disk-to-disk-to-tape (D2D or D2D2T) backup procedure). This common solution leverages the strengths of both disk and tape media to improve backup efficiency. Usually, disk media is used as a staging area to store data for short time periods (for example, a week to a month), while tape is used for long-term data retention. This results in a solution that performs well and is cost effective over time.

PS Series storage can be used with many backup applications as disk backup media. It is recommended to create a separate pool when utilizing PS Series storage for a disk backup media location for best performance and to ensure that the disk based backup is not on the same physical disks as the data that is being protected.

Using Near-Continuous Backup and Archiving

Another method of protecting Windows Server data is by using a near-continuous backup and archiving solution that unifies data protection, disaster recovery, and archiving. This type of solution provides immediate data recovery; file, e-mail, and database storage optimization; instant user access; and regulatory compliance. Copies of data can be maintained on a separate server and continuously updated as the data changes. If a catastrophic failure occurs, the data loss is zero or at most a few minutes.

Backup applications that support near continuous backup and archiving fall under different categories and include the following:

- **Dell MessageOne** MessageOne's platform provides rapid deployment and low total cost of ownership for email business continuity and crisis management. For more information contact your Dell representative.
- **Microsoft Data Protection Manager (DPM)** – DPM optimizes disk-based backup and recovery. It provides continuous data protection for file servers. See the following for more information:

<http://www.microsoft.com/windowsserversystem/dpm/default.mspx>

Also, see the *Deploying Microsoft System Center DPM 2006 in an iSCSI SAN* Technical Report on the EqualLogic website:

<http://www.equallogic.com/resourcecenter/documentcenter.aspx>

- **Veritas® (Symantec®) Backup Exec** – Provides near-continuous data protection and web-based, end-user file recovery functionality. See the following for more information:

<http://www.veritas.com/Products/www?c=product&refId=449>

Also, see the *Deploying Symantec Backup Exec 10d for Windows Servers with PS Series Arrays* Technical Report on the EqualLogic website:

<http://www.equallogic.com/resourcecenter/documentcenter.aspx>

- **CommVault** - CommVault® Simpana® Backup & Recovery is an “iSCSI aware” data and storage management solution that has been engineered for adaptive deployment, superior performance, and painless automation. Through Storage Policies, CommVault helps make it simple to implement even the most intricate data and storage management strategies and enforce them across your enterprise. Its innovative architecture allows the CommVault storage management intelligence to integrate with iSCSI SANs.

Using PS Series Auto-Replication Technology

PS Series arrays include auto-replication technology that enables disaster recovery of volumes by replicating volume data from one PS Series group to another. If the primary group is destroyed, volume data can be recovered from the recovery group and servers can be configured to access the data from the new location.

Similar to a snapshot, a replica represents the contents of a volume at a specific point in time. However, unlike a snapshot, a replica is located in a group separate from the group where the original volume resides. Because the volume and the replicas are physically separated, a complete disaster at one site does not destroy the data at the other site.

For more information on auto-replication, see the *Sizing Replication Space* Technical Report on the EqualLogic Customer Support website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>), as well as Chapter 7 of the *PS Series Storage Arrays Group Administration* guide.

PREPARING FOR DEPLOYMENT

This section will list information and examples of deploying a Windows Server 2008 host with a PS Series SAN. In addition, information about configuring the server for multipath I/O, using Challenge Handshake Authentication Protocol (CHAP) to restrict volume access, and booting from the SAN is included, although these tasks are optional.

Detailed information about setting up and managing a PS Series group and using Auto-Snapshot Manager can be found in the documentation described in *EqualLogic Documentation and Customer Support*.

Technical Reports, located on the EqualLogic Customer Support website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>), provide detailed information about deploying various applications and configurations with PS Series storage.

Be sure to read *Planning and Design Considerations* before beginning the deployment. This will help you create a high-availability, high-performance configuration.

In addition, the following can be useful:

- Windows Server 2008 Deployment:
<http://technet.microsoft.com/en-us/cc339386.aspx>
- Microsoft iSCSI Software Initiator version 2.07 description:
<http://www.microsoft.com/downloads/details.aspx?FamilyID=12cb3c1a-15d6-4585-b385-befd1319f825&DisplayLang=en>
- Microsoft MPIO description:
<http://www.microsoft.com/windowsserver2003/technologies/storage/mpio/default.mspx>

Basic Steps for Deploying Windows with a PS Series SAN

The bulk of the second half of this technical report describes those operations, which are:

- Set up the PS Series group and Create Volumes
- Set up the Windows server
- Connect to PS Series volumes
- Configure basic disks
- Assign drive letters and format partitions

Repeat steps as necessary to prepare each volume.

The following sections provide basic information for deploying Windows server with a PS Series SAN. This information includes how to set up and access the group, set up pools, volumes, and access controls, and configure CHAP for host authentication.

In addition:

The PS Series *QuickStart* contains detailed PS Series storage array installation and group setup information.

The *Group Administration* manual contains comprehensive information about group administration and advanced features like snapshots and replication and focuses on how to use the Group Manager graphical user interface (GUI) to perform the tasks.

The *CLI Reference* manual describes how to use the command line interface (CLI) to manage the group and individual arrays (only for maintenance purposes).

The *Network Connection and Performance Guidelines* technical report aides in setting up the network connections for optimum performance.

Always read the PS Series *Release Notes* for the latest product information, information about firmware updates, and browser requirements for accessing the GUI.

Set up the PS Series Group and Create Volumes

Install the hardware and connect the network cables according to the PS Series QuickStart and Group Administration guides. The EqualLogic Remote Setup Wizard or a serial cable can be used to initially configure the array and create a group. See the Host Integration Tools for Microsoft Windows *User Guide and Release Notes* for detailed installation and setup information.

See *Choose the Optimal RAID Level* for information about choosing the member RAID level that will give you the best performance under all conditions for you particular applications.

To enable load balancing of the iSCSI network, connect and configure multiple network interfaces on each array. See the Technical Report *Storage Array Network Performance Guidelines* on the EqualLogic website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>) for more information.

Use the Group Manager GUI or CLI to create the volumes you need for your Windows environment. If you want to create snapshots of the volume or use VSS to backup a volume, be sure to reserve snapshot space. For each volume, be sure to create one or more access control records that will permit access to authorized hosts, while denying access to other hosts.

Controlling Host Access to Volumes

Access control records are used to restrict host access to volume data in a PS Series group. A group volume and its snapshots share a list of access control records (sometimes called the access control list or ACL). Access control can be configured to apply to the volume, its snapshots, or both, as needed. Access control can be created at the time of volume creation or modified at any time.

For example, in the Group Manager GUI, select the volume name in the far left panel, click the **Access** tab in the window that appears, and then either click **Add** or select an existing record and click **Modify**. If you click **Modify**, the Modify Access Control Record dialog box (Figure 3) appears.

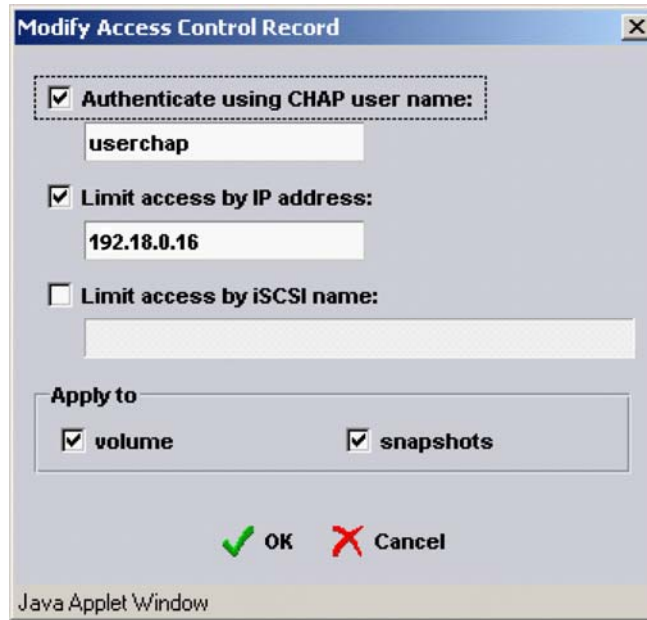


Figure 3: Group Manager – Modify Access Control Record

Access control can be specified using an IP address of one of the server network interfaces, an iSCSI initiator IQN name, or a CHAP user name (or any combination). A server must match *all* the requirements in *one* record in order to access the volume or snapshot. Access control can be designated for the volume or snapshots or both.

The most secure way to control access to volumes is to use a combination of IP address and CHAP. For example, if a record includes both an IP address and a CHAP user name, a server must present the IP address *and* supply the CHAP user name and its associated password (using the iSCSI initiator) in order to match the record.

Notes: If you use IP addresses or iSCSI initiator names to restrict access, create an access control record for each IP address or initiator name presented by the server. For example, if a server has two NICs that are handling iSCSI traffic, create two records, one with the IP address assigned to one NIC and the other with the IP address assigned to the other NIC. This ensures that the server can access the volume (or snapshot), regardless of which NIC is used for the connection.

To use CHAP to restrict host access to volumes, configure CHAP in the group, as described in the *Group Administration* guide. When using CHAP to restrict host access, it is recommended to also specify an IP address in an access control record. If only a CHAP user name is specified in a record, initiators that support discovery will unsuccessfully try to connect to the volume, increasing event log activity.

Once the access control information is entered, click **OK** to create the record. The record should appear in the Volume Access window (Figure 4).

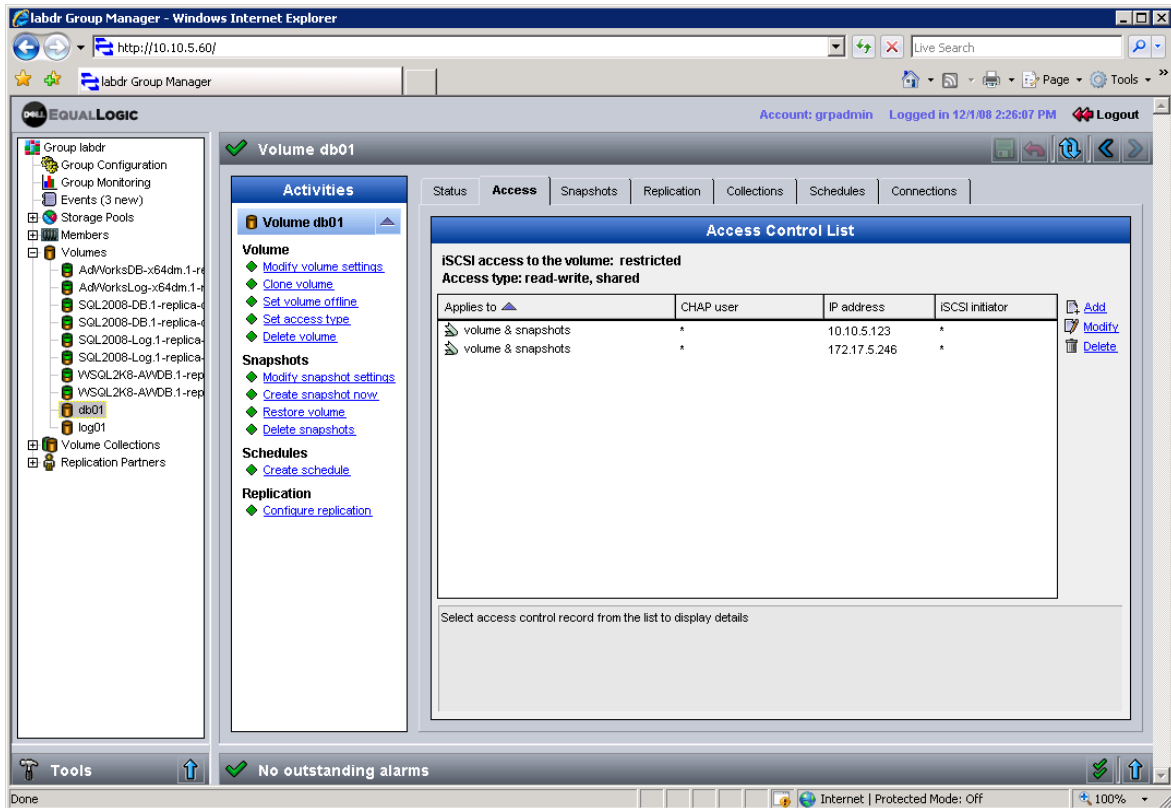


Figure 4: Volume Access Control List

Configure CHAP

To use Challenge Handshake Authentication Protocol (CHAP) to restrict host access PS Series volumes, configure CHAP in the group.

CHAP is a network login protocol that uses a challenge-response mechanism. With CHAP authentication, volume or snapshot access can be restricted to hosts that supply the iSCSI initiator with the correct user name and password (or “secret”) combination. This information must match an access control record for the volume, in addition to an entry in a CHAP database, in order to gain access to the volume.

CHAP can be implemented in a group in the following ways:

- **Local CHAP accounts configured in the group** – Local CHAP is not dependent on any external system and is easy to deploy if you have few accounts to maintain.
- **External RADIUS server whose IP address is configured in the group** – An external RADIUS server is beneficial to manage a large number of CHAP user names and passwords. However, the availability of the server will affect host access. For more information on configure CHAP with a RADIUS server, see the technical report *Using Active Directory for Account Authentication to a PS Series Group* on the EqualLogic support website: (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

To use the Group Manager GUI to configure CHAP in a group, click **Group Configuration** in the far left panel and then click the **iSCSI** tab as shown in Figure 5. Use the **Add** option in the **Local CHAP Accounts** section to add a new CHAP account. See the *Group Administration* manual for more information.

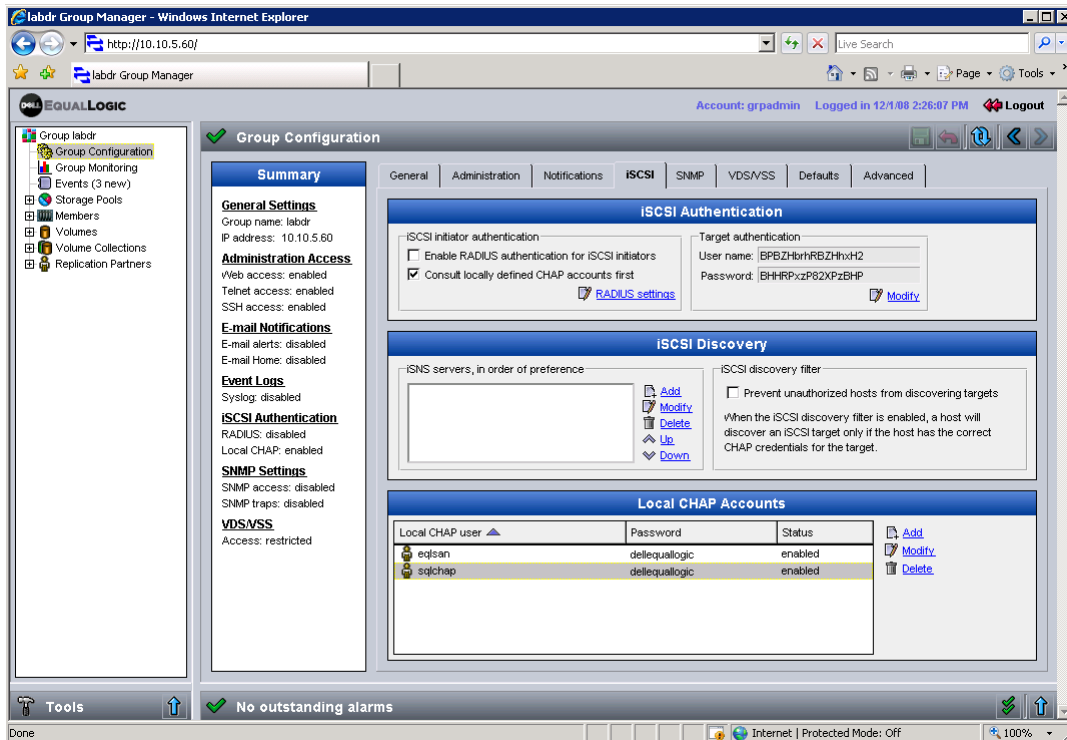


Figure 5: Group Manager – CHAP account setup

Set up the Windows Server

This section assumes server hardware has been set up with dedicated network interfaces or HBA's for iSCSI SAN traffic. The following topics will be covered in this section:

- Installing the Host Integration Tools Kit for Windows
- Configuring multipath I/O using the EqualLogic MPIO DSM
- Preparing a host for VSS protection and Auto-Snapshot Manager

Installing the Host Integration Tools Kit for Windows

The Host Integration Tools Kit for Windows consists of the following utilities:

- The Microsoft iSCSI initiator service (only needed on pre-Windows 2008 systems)
- Auto-Snapshot Manager-Microsoft Edition (VSS integration application)
- EqualLogic MPIO DSM (Device Specific Module)
- The Remote Setup Wizard utility
- The Manual Transfer Utility

The Host Integration Tools are shipped on a CD with a PS Series array or downloadable via <https://www.equallogic.com/support/>. The Host Integration Tools supports x86 and x64 based operating systems. For more information about installation requirements refer to the Host Integration Tools for Windows documentation.

Once installed configure the host to access a PS Series SAN. Using the *Remote Setup Wizard* setup utility, choose the option to **Configure this computer to access a PS Series SAN** and click **Next**. This will open the host configuration wizard. On the right side of the window choose **Add Group** to add the PS Series group name and IP address. Additionally add a CHAP username and password to use CHAP authentication or enable VSS authentication to the group, (Figure 6).

When the information has been entered click **Save** to save the configuration to the host. The PS Series group will appear in the *Groups assessable from this computer* box. Click **Finish** to close the host configuration wizard.

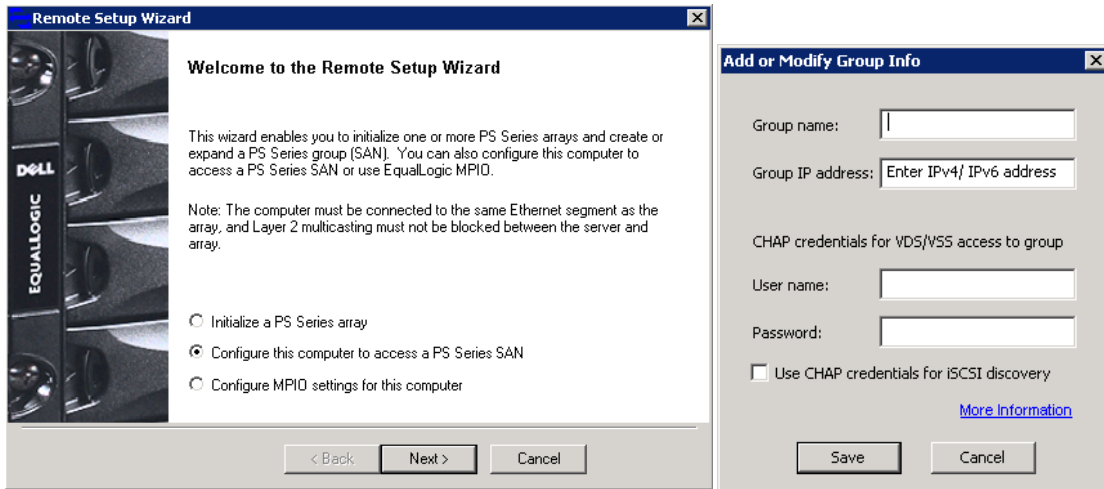


Figure 6: Remote Setup Wizard – Configure host to access a PS Series SAN

Configuring Multipath I/O using the Dell EqualLogic MPIIO DSM

The EqualLogic MPIIO DSM (Device Specific Module) can be installed with the Host Integration Tools kit for Windows. This MPIIO DSM is developed using the Microsoft native MPIIO driver stack but enhanced with a connection awareness module that recognizes and is aware of PS Series volume connections and the array network load balancing characteristics. The DSM increases server performance by enabling iSCSI traffic through multiple network interfaces as well as ensures best practice deployments with PS Series arrays. For more information on the MPIIO DSM, see the technical report *Configuring and Deploying the Dell EqualLogic MPIIO DSM in a PA Series SAN* on the EqualLogic support website: (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Once installed the MPIIO DSM can be configured by starting the Remote Setup Wizard and choosing the **Configure MPIIO settings for this computer** option as shown in Figure 5 above. Click **Next** to open the MPIIO configuration settings window.

In the MPIIO configuration settings window (Figure 7), add the iSCSI network subnet into the *Subnets included for MPIIO* and the client network subnet into the *Subnet excluded from MPIIO*. Additionally choose the default load balancing policy. Dell recommends setting the default load balancing policy to **Least Queue Depth** for optimum performance with PS Series arrays. For information on installing and configuring the EqualLogic MPIIO DSM, please refer to the Host Integration Tools for Windows *Release Notes* and *User Administration Guide*.

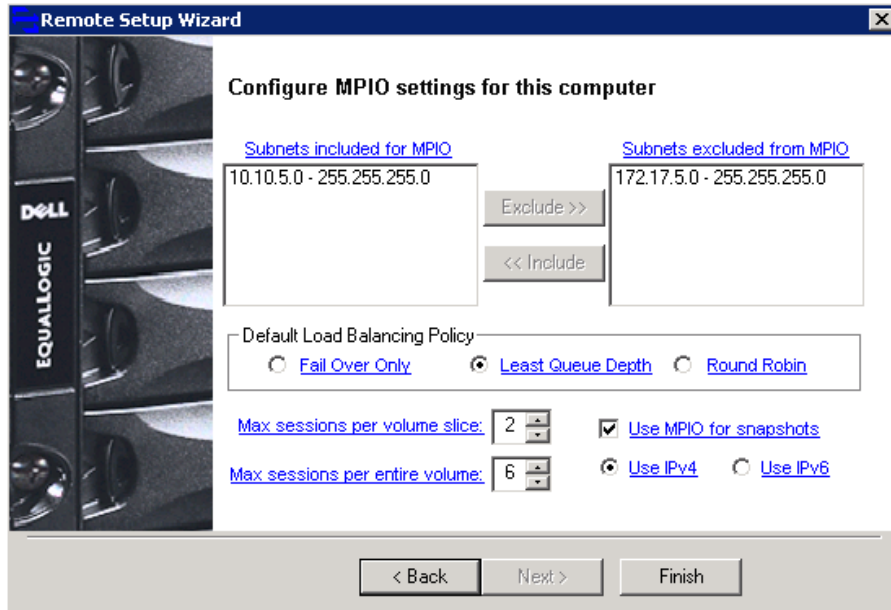


Figure 7: Remote Setup Wizard – MPIO Settings

Preparing a host for VSS protection and Auto-Snapshot Manager-Microsoft Edition

In order for a host to use the PS Series VSS and VDS provider services the host must authenticate to a PS Series SAN using CHAP authentication. CHAP authentication is setup using CHAP accounts described earlier in the [Configure CHAP](#) section.

Once the new CHAP account is created it must be added to the VDS/VSS access list. Click the **VDS/VSS** tab to view the account list and add a new CHAP account to the list. The **Create access control record** dialog window will appear, Figure 8. Add the CHAP username in the top control option and click **OK** to complete the process.

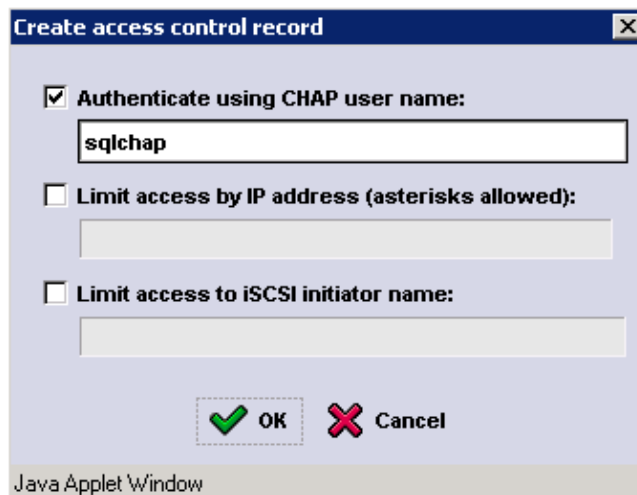


Figure 8: VDS/VSS CHAP access control

Now set the same CHAP credentials on the Windows server host by using the **Remote Setup Wizard – Configure this computer to access a PS Series SAN** option as described earlier in the [Installing the Host Integration Tools](#) section. Once complete CHAP authentication between the server and the PS Series group is now set.

In order to confirm proper authentication open the **iSCSI Initiator Properties – Targets** tab and verify that the **vss-control** volume is listed in the targets list. The vss-control volume is not a physical iSCSI volume but is used as the VDS/VSS communications mechanism between the host and the PS Series group.

The vss-control volume will appear inactive until a VSS aware application such as Auto-Snapshot Manager-Microsoft Edition (ASM-ME) is started on the host. Since ASM-ME is a VSS aware application it will try to authenticate with the PS Series groups listed in the **iSCSI Initiator Properties – Discovery** area. When authentication passes the vss-control volume will appear in a connected state in the **Targets** list. For more information on Auto-Snapshot Manager – Microsoft Edition and VSS operations please refer to the Host Integration Tools documentation and EqualLogic support site.

Connect to PS Series Volumes

Using a supported iSCSI initiator, connect to the PS Series volumes on a PS Series SAN. For the latest iSCSI Initiator list refer to the latest iSCSI initiator matrix at:

http://www.equallogic.com/psp/PDF/Initiator_external.pdf

When connecting to PS Series iSCSI volumes determine the following:

- If the volume should be persistently connected so the connection is established each time the server boots.
- If MPIO is installed and configured on the server connecting to the volume.
- If the volume is to be used in an application such as SQL Server or Exchange Server the volume should be bound to a drive letter.

The following steps describe how to connect the server to a PS Series volume. A volume is seen on the network as an iSCSI target. When you create a volume, the PS Series group automatically generates the iSCSI target name with a unique identifier called an *iqn* string. The volume name is appended to the end of the iqn string in the target name.

This section focuses on using the Microsoft iSCSI Software Initiator to connect to a volume.

1. Launch the Microsoft iSCSI initiator. Click **Start > Control Panel > Microsoft iSCSI Initiator**. The iSCSI initiator Properties dialog box (Figure 9) appears.

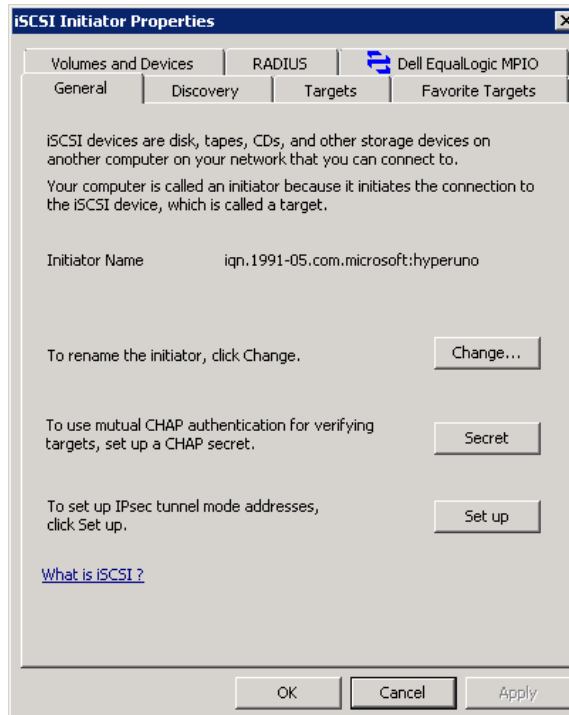


Figure 9: Microsoft iSCSI Initiator Properties

2. Click the **Discovery – Add Portal**. The Add Target Portal dialog box in Figure 10 appears. Specify the PS Series group IP address (or its DNS name). Then, click **OK**. This will enable the initiator to “discover” the iSCSI targets associated with the group volumes.

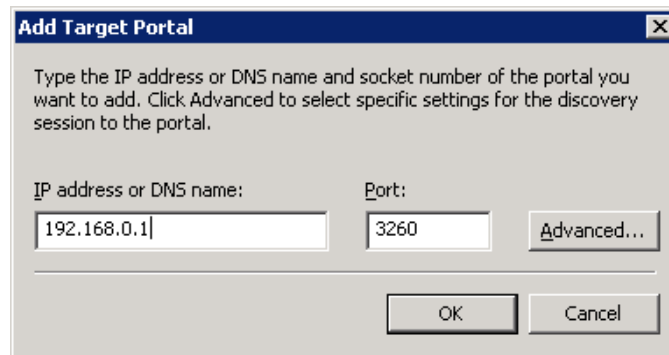


Figure 10: Microsoft iSCSI Initiator Properties – Add Target Portal

3. In the Microsoft iSCSI Initiator Properties dialog box, click the **Targets** tab (Figure 11).

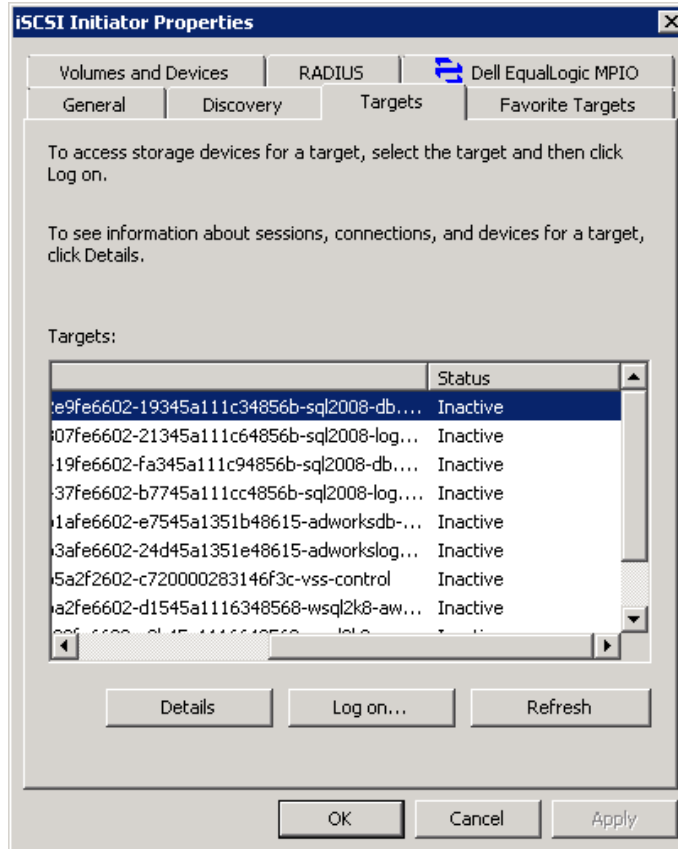


Figure 11: Microsoft iSCSI Initiator Properties – Targets Tab

4. Select the desired iSCSI target and click **Log On**. In the *Log On to Target* dialog box (Figure 12), check the box next to **Automatically restore this connection when the system reboots**. This will create a persistent connection to the volume and ensure the volume will be connected if the server reboots.

Single Interface Log On

MPIO Log On

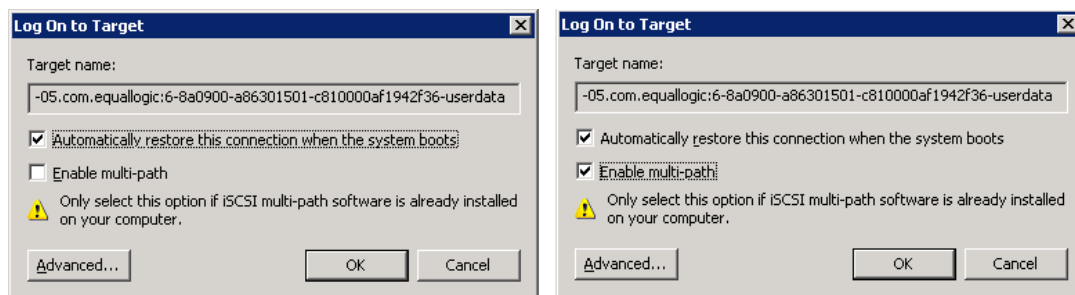


Figure 12: Microsoft iSCSI Initiator Properties – Log On to Target

If you are using the EqualLogic MPIO DSM, in the *Log On to Target* dialog box, check the box **Enable multi-path**. The DSM will make the appropriate connections to the volumes and populate the target sessions list in the *Initiator Properties – Details* view for the volume. If native Microsoft MPIO driver is being used click **Advanced**. This enables manual configuration of specified physical paths to the same target. For manual configuration of the Microsoft native MPIO driver, see the EqualLogic Technical Report

Deploying Microsoft Multipath IO in an iSCSI SAN on the EqualLogic support website: (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

5. If the volume requires CHAP credentials, click **Advanced** in the Log On to Target dialog box. The Microsoft iSCSI Initiator Properties – Advanced Settings dialog box (Figure 13) appears. Set the **CHAP logon information** check box and specify the CHAP user name and secret. The user name must match an access control record for the volume. In addition, the user name and password must match a record in a CHAP database set up locally in the PS Series group or on an external RADIUS server. Click **OK** when done.

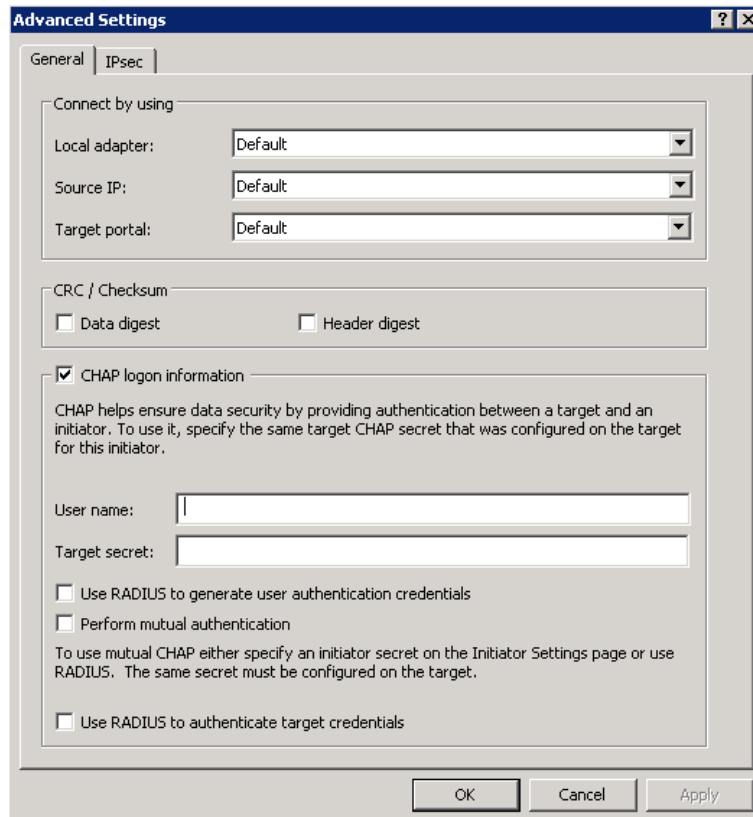


Figure 13: Microsoft iSCSI Initiator Properties – Advanced Settings

6. In the Log On to Target dialog box, click **OK** to complete the login.
7. Confirm the connection by clicking the **Targets** tab in the Microsoft iSCSI Initiator Properties dialog box. The target should appear in the list with the status **Connected**.
8. Click the **Volumes and Devices** tab (Figure 14). To ensure that the volume will be available when the iSCSI service is started by Windows, click **Add** or **Autoconfigure** to bind a volume to a specific drive letter. Then, click **OK**. If applications are running that will use these volumes (for example, SQL or Exchange), perform the bind after assigning a drive letter. When complete the bound volumes will appear in the **Favorite Targets** tab.

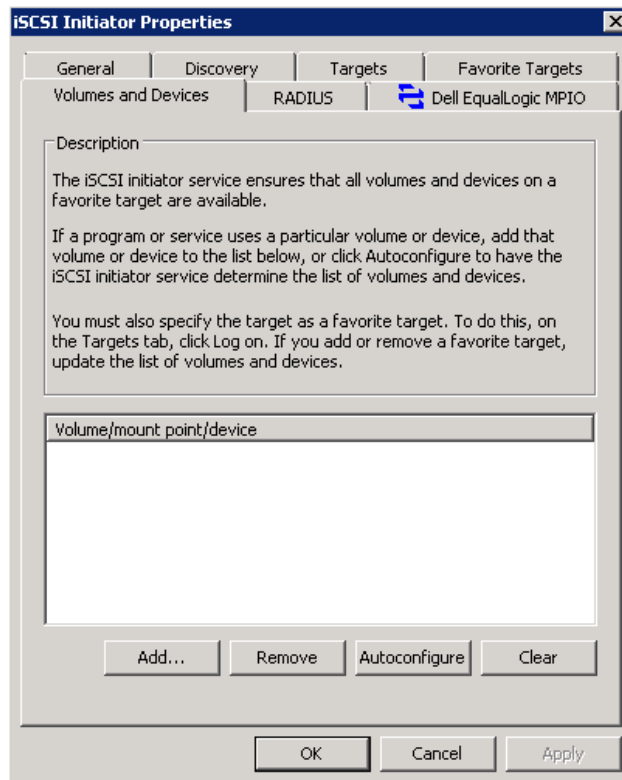


Figure 14: Microsoft iSCSI Initiator Properties – Volumes and Devices Tab

Configure Basic Disks

Configuring basic disks on Windows Server 2008 is accomplished after the volume has been logged into. A new volume will initially appear offline in an unformatted, unpartitioned disk in the server Disk Management view. In order to create partitions on new volumes users will have to place the volume online and initialize the volume. This section will describe options for configuring basic disks on Windows Server 2008.

Disk Sector Alignment

Windows Server 2008 will perform auto-alignment of storage volumes when they are initialized and formatted for the first time on a Windows 2008 server. The user may choose to override the default alignment. For more information, see the Technical Report *Microsoft Windows: Aligning Disk Sectors for Optimal Performance* on the EqualLogic website: (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

Assign Drive Letters and Format Partitions

After you have aligned disk sectors and created a basic disk, the new volume will be seen in the Disk Management utility as with the status *On-Line* and *Healthy*. In this section, a disk associated with a connected PS Series volume is referred to as an iSCSI disk.

Note: Although you can create multiple disk partitions on an iSCSI disk, it is recommended that you only use one partition.

To assign a drive letter and format an iSCSI disk, follow these steps:

1. Open **Server Manager > Storage > Disk Management** to view the new iSCSI volume. The volume will initially show up in an off-line state. To set the new volume online either right click in the **Unknown** section of the disk, shown in Figure 15 or use the **Action – All Tasks** option to set the disk online.

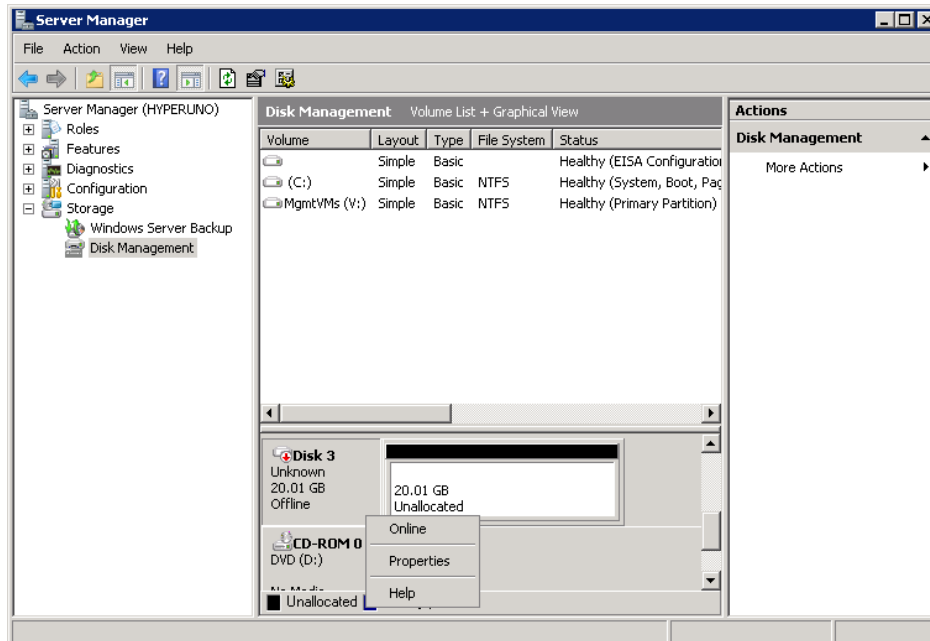


Figure 15: Disk Management – Set Disk Online

2. Once online, right-click the same area to initialize the disk. During initialization a pop-up window will require a partition style choice, Figure 16. MBR (Master Boot Record) will be the most common partition style however Microsoft recommends setting the partition style to GPT (GUID Partition Table) for large partitions greater than 2TB.

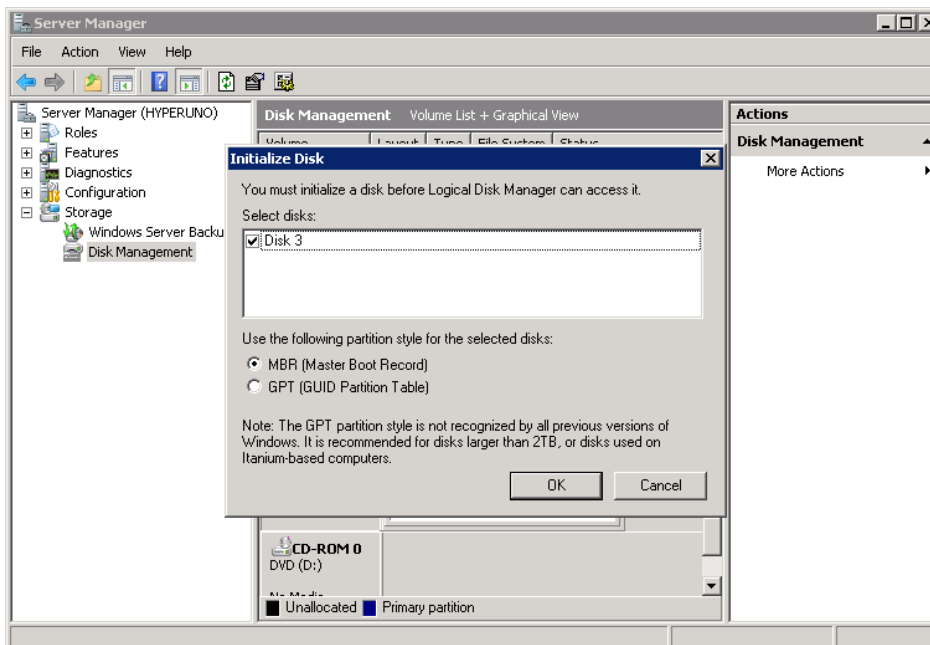


Figure 16: Disk Management – Set Partition Style

- After initializing the disk, create a partition by right-clicking in the **Unallocated** space and choosing **New Simple Volume...** as shown in Figure 17. This will start the New Simple Volume creation wizard. Step through the wizard and create the new volume by selecting the volume size, drive letter, file system format type (NTFS is recommended), and optionally give the new volume a label. It is recommended to perform a long format if this volume is used for production purposes. If this volume is for a test then a quick format is acceptable.

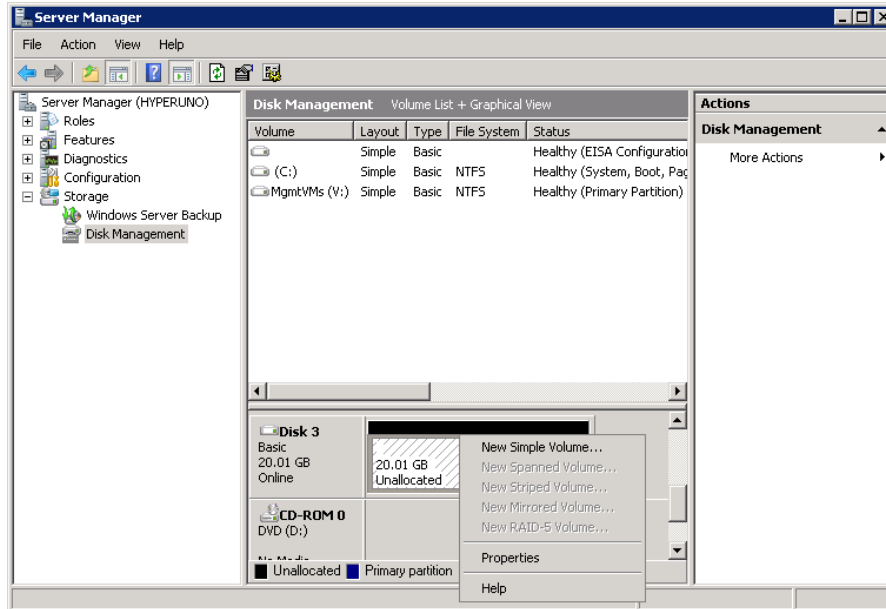


Figure 17: Disk Management – New Simple Volume

- If the disk had a previous partition formatted on it the drive letter may need to be changed. Right-click on the partition and choose **Change Drive Letter and Paths** to add or change the drive letter of the existing partition. In the Change Drive Letter and Paths dialog box, click **Add**. In the **Add Drive Letter or Path** dialog box, click **Assign the following drive letter** and then assign the drive letter (Figure 18). Then, click **OK**. The drive letter will appear by the iSCSI disk in the Disk Management utility.

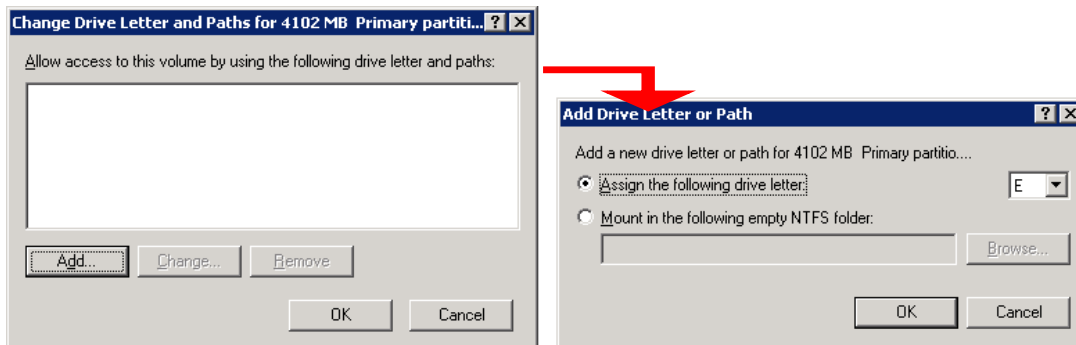


Figure 18: Disk Management – Add Drive Letter or Path

- To format the existing partition, right-click the white box next to the iSCSI disk, and in the shortcut menu that appears, select **Format** (Figure 19).

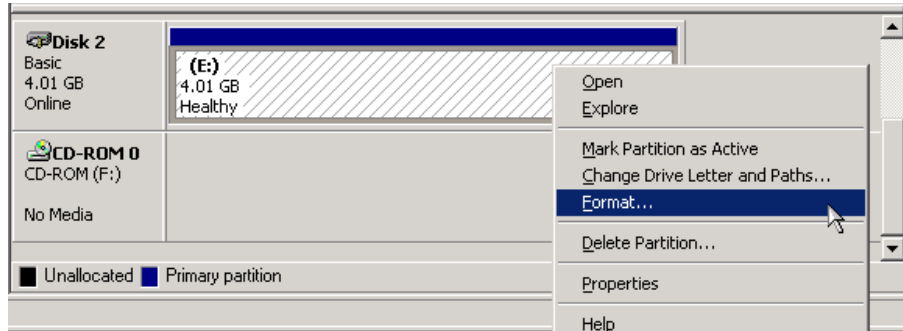


Figure 19: Disk Management – Drive Letter Assigned

ADDITIONAL OPERATIONS

The following sections describe additional operations that are related to working with Windows Server 2008 in an iSCSI SAN, but that are not part of the core, design, plan, and implement process. These operations include:

- Expanding SAN storage online
- Shrinking a Windows Server Volume
- Backing up data with VSS

Expanding SAN Storage Online

As the storage requirements increase for the server applications and users, you can easily expand individual PS Series volumes and SAN capacity, online and without disruption.

You can increase the size of a PS Series group volume by using the Group Manager GUI or CLI. You must then enable Windows to recognize the size change.

If you need more SAN capacity to accommodate new volumes or expanded volumes, you can add more members to the PS Series group. See *Increasing PS Series Group Capacity* later in this section for more information.

Increasing the Size of a PS Series Volume

You can use the Group Manager GUI or CLI to increase the size of a PS Series volume without disrupting users. You do not need to reboot servers, and the space will be immediately available.

Follow these steps to use the Group Manager GUI to increase the size of a volume:

1. Expand **Volumes** in the far left panel of the Group Manager, and select the volume to increase.
2. In the **Group Manager > Activities** panel of the window that appears, click **Modify volume settings**. In the Modify Volume Settings window, verify that the “Free pool space” displayed in the Space utilization table is larger than the desired expansion size.
3. Select the **Space** tab and specify the new volume size, as shown in Figure 20. When finished, click **OK**.

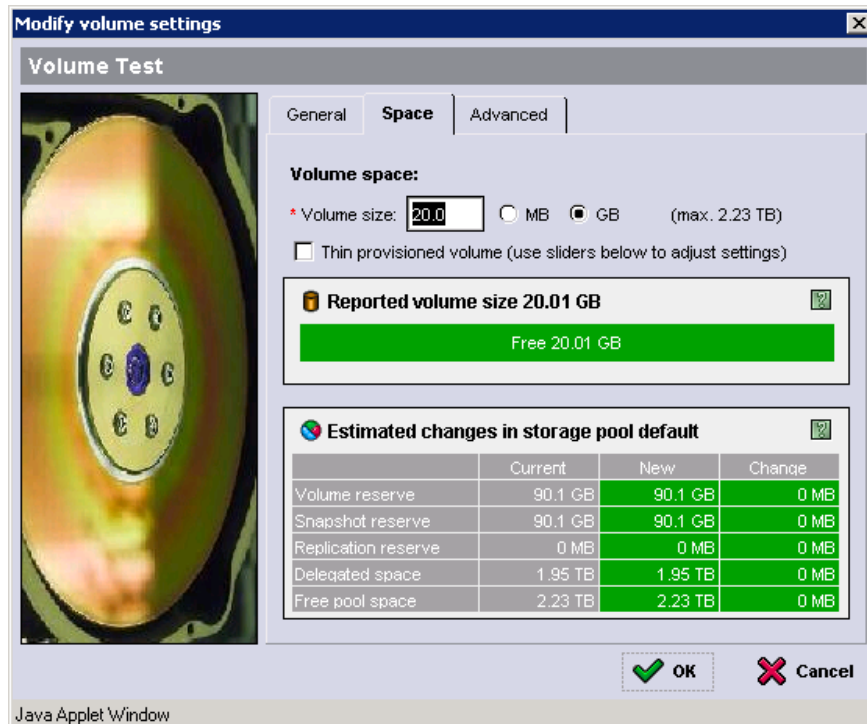


Figure 20: Modify Volume Settings

To enable Windows Server to recognize the volume size increase, you must rescan the disks in the Disk Management utility. The new space will show up as *Unallocated* space in the Disk Management view. To increase the partition size right-click the Primary Partition and choose **Extend Volume...** from the menu as shows in Figure 21. Follow the wizard to choose the size the extension to complete the process.

Additionally the DiskPart.exe utility can be used to increase a volume's size. For more information, see the Technical Report *Microsoft Windows: Expanding Basic Disk Volumes* on the EqualLogic website (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>).

If additional PS Series storage capacity is needed in order to create more volumes or expand volumes, you can add more members (arrays) to the PS Series group. Once the array has been added to the group, volume data will be load balanced across all the group members and the group capacity expanded. You can then add new volumes or increase the size of existing volumes.

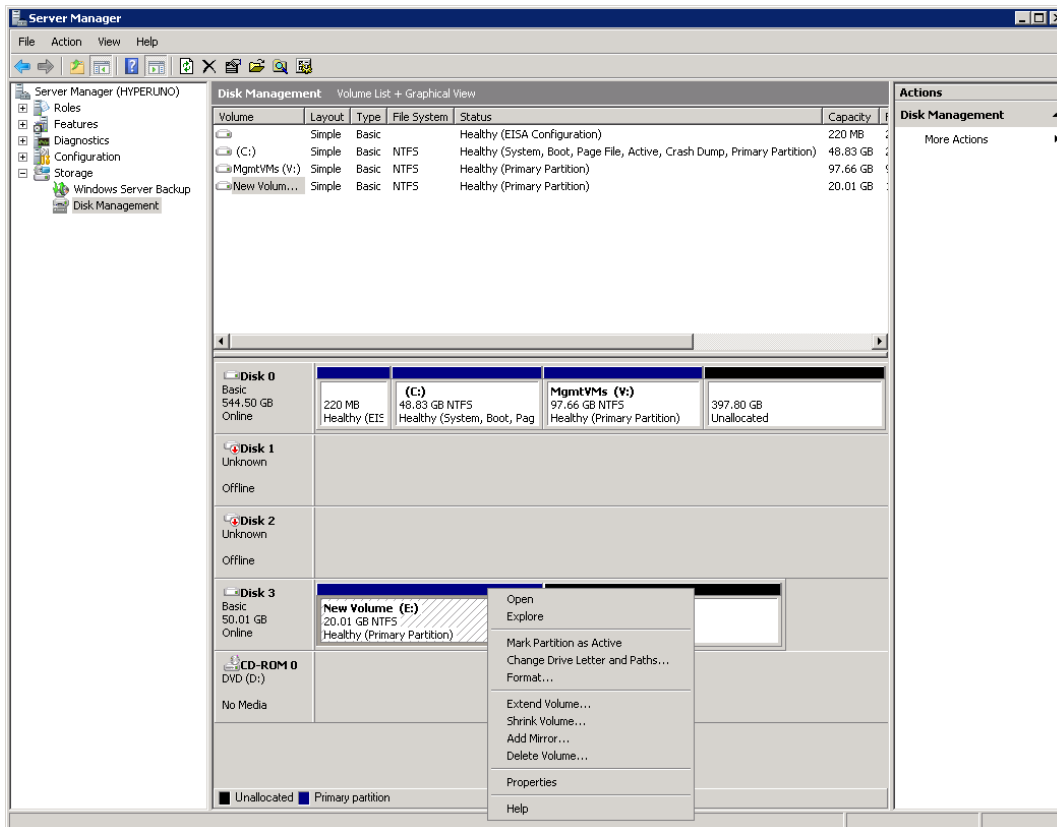


Figure 21: Disk Management – Extend Volume

Shrinking Windows Server 2008 Volumes

Windows Server 2008 also allows you to shrink the partition of a volume through the Disk Management utility. Shrinking a volume's partition is allowable if there is available space on the partition. During a shrink operation files are automatically relocated on the disk to make room for the unallocated space.

In order to shrink a volume partition, the volume must have no file system or the partition file system must be NTFS. For more information on how to shrink basic volumes, see the TechNet article on Microsoft.com: <http://technet.microsoft.com/en-us/library/cc731894.aspx>.

Backing Up Data with VSS

VSS provides a framework that integrates VSS-aware storage hardware and applications with operating system drivers to create point-in-time copies of data—delivering a turn-key backup solution to IT departments without the need for scripting.

Using the Auto-Snapshot Manager VSS provider, a backup application VSS requestor, and an application with a VSS writer (such as NTFS, Exchange Server, or SQL Server), you can quickly and easily perform coordinated backups of data stored in a PS Series group.

See the Technical Reports on the EqualLogic website for information on backing up particular VSS-aware applications to a PS Series group. (<http://www.equallogic.com/resourcecenter/documentcenter.aspx>)

SUMMARY

An iSCSI SAN comprised of Dell EqualLogic PS Series storage arrays provide an ideal storage infrastructure for Windows Server installations. A PS Series SAN brings all the reliability and performance needed for a successful deployment. As the storage requirements grow and the workload increases, the SAN can scale easily, while maintaining availability.

An important part of a successful Windows Server implementation is to follow Microsoft's recommendations for Windows configurations and for the applications you are running. You should also follow the best practices described in this Technical Report to ensure a robust installation that will meet your needs now and in the future.

FOR MORE INFORMATION

For detailed information about PS Series arrays, groups, and volumes see the following documentation:

- *Release Notes*. Provides the latest information about PS Series storage arrays and groups.
- *QuickStart*. Describes how to set up the hardware and start using a PS Series storage array.
- *Group Administration*. Describes how to use the Group Manager GUI to manage a PS Series group. This manual provides comprehensive information about product concepts and procedures.
- *CLI Reference*. Describes how to use the Group Manager command line interface to manage a group and individual arrays.
- *Hardware Maintenance*. Provides information on maintaining the PS Series storage array hardware.

The *QuickStart* and *Hardware Maintenance* manuals are printed and shipped with the PS Series array.

They are also located on the documentation CD-ROM that is shipped with the array, along with the *Group Administration* and *CLI Reference* manuals and the Group Manager online help.

The Host Integration Tools kit and documentation will be available on the support website (support.dell.com/EqualLogic) and on a CD-ROM that is shipped with the PS Series array.

TECHNICAL SUPPORT AND CUSTOMER SERVICE

Dell's support service is available to answer your questions about PS Series arrays. If you have an Express Service Code, have it ready when you call. The code helps Dell's automated-support telephone system direct your call more efficiently.

Contacting Dell

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area.

For customers in the United States, call 800-945-3355.

Note: If you do not have an Internet connection, you can find contact information on your purchase invoice, packing slip, bill, or Dell product catalog.

To contact Dell for sales, technical support, or customer service issues:

1. Visit support.dell.com.
2. Verify your country or region in the Choose A Country/Region drop-down menu at the bottom of the window.
3. Click `CONTACT US` on the left side of the window.
4. Select the appropriate service or support link based on your need.
5. Choose the method of contacting Dell that is convenient for you.

Online Services

You can learn about Dell products and services on the following websites:

- www.dell.com/
- www.dell.com/ap/ (Asian/Pacific countries only)
- www.dell.com/jp (Japan only)
- www.euro.dell.com (Europe only)
- www.dell.com/la (Latin American countries)
- www.dell.ca (Canada only)

You can access Dell Support through the following websites:

- support.dell.com
- support.dell.com/EqualLogic
- support.jp.dell.com (Japan only)
- support.euro.dell.com (Europe only)